

Reconsideration and re-examination are hereby requested.

The claims stand rejected under 35 USC 103 as being unpatenable over Maguire in view of Serpek.

Before discussing the claims and how they distinguish over the prior art, perhaps it might be helpful to review features of Applicant's invention in view of the Maguire and Serpek

It is first noted that process described in Maguire for producing ALON powder requires a **two step** heat treatment to produce ALON powder from a mixture of alumina and carbon black, through carbo-thermal reduction. The first step occurs at 1550°C and is the conversion of the gamma alumina into a combination of alpha alumina and aluminum nitride. This step is described as requiring approximately 1 hour for full conversion. The second step occurs at 1750°C, and is the conversion of the alpha alumina and aluminum nitride into ALON. This second step is described as taking approximately 40 minutes. The patent by Serpek describes the use of a rotary calciner, a preferred method of continuous processing, to produce aluminum nitride from a mixture of alumina and carbon black. This represents only the first step of the Maguire process, if you adjust the ratio of the alumina and carbon black so that all of the alumina is converted into aluminum nitride. In order to complete the reaction, the powder would have to be run through a second rotary calciner at the higher temperature, to produce ALON powder. **To reiterate, the simple application of the earlier art represents a two step process.**

In accordance with one embodiment of Applicant's invention, the ALON powder is produced in a single heat treatment step using a continuous process. APPLICANT HAS DISCOVERED THAT BY PROVIDING A CHAMBER HAVING A TEMPERATURE GREATER THAN 1700 °C AND HAVING MIXTURE COMPRISING ALUMINUM OXIDE AND CARBON THE MIXTURE AGITATED IN THE CHAMBER A **SINGLE HEAT TREATMENT STEP** CAN PRODUCE ALON. Rather than use a two step process, Applicant describes a single step process. This is a key difference between the earlier art and the current application. It is the combination of the continuous processing, which provides for a uniform reaction environment for the powder precursors, and the reaction times for the chemical processes described, which allow this to occur. It is this combination which is unique. The **single step reaction can take place in MINUTES, rather than HOURS as the earlier patents claim.**

Furthermore, it is the combination of continuous processing and fast reaction times which allow the ALON powder to be produced at high rates at a low cost, required for commercialization of this material. The simple application of the earlier art requires two rotary calciners to be purchased (i.e., double the capital investment), and twice the processing time. These two factors would result in roughly doubling the cost of producing ALON powder. Based on the arguments presented, the subject invention represents a significant innovation, not a trivial extension of prior art. Reconsideration is hereby requested.

NOTHING IN EITHER MAQUIRE OR SERPEK describes, suggests or recognizes that ALON can be produced by a single step process.

In accordance with another embodiment of the invention, the ALON is made in a semi-continuous or somewhat batch process with the chamber ramped to a temperature greater than or equal to 1700°C. As pointed out in the patent application: " ... at ramp rate of greater than 10-20 °C/min to a soak temperature of about 1700-1900 °C, preferably about 1825 °C. The soak time is about 10-30 minutes, preferably about 15 minutes". The semi-continuous process can shorten the time needed to synthesize multiple batches of ALON, for example, by reducing the time needed to ramp the furnace to a soak temperature, the time needed for the furnace to cool, and the time needed to re-load the retort and to remove the formed ALON from the retort. The semi-continuous process also provides convenient handling of reactants and products.

Referring now to the claims, claim 1 points out that the method includes providing a chamber having a temperature therein greater than or equal to 1700°C; introducing aluminum oxide particles into the provided chamber; dispersing the particles within the provided chamber; and forming the aluminum oxynitride comprising passing nitrogen gas over the dispersed particles. Such method is not described or suggested in Maquire or Serpek taken either singly or in combination. As pointed out above, APPLICANT HAS DISCOVERED THAT BY PROVIDING A CHAMBER HAVING A TEMPERATURE GREATER THAN OR EQUAL TO 1700 °C AND HAVING A MIXTURE AGITATED IN THE CHAMBER A **SINGLE HEAT TREATMENT STEP** CAN PRODUCE ALON. In accordance with one embodiment of Applicant's invention, the ALON powder is produced in a single heat treatment step using a continuous process. Rather than use a two step process, Applicant describes a single step

process.

Referring now to claim 3, such claim points out a method of making aluminum oxynitride, the method comprising: providing a chamber having a temperature therein greater than or equal to 1700°C; introducing a mixture comprising aluminum oxide and carbon. into the provided chamber; dispersing the particles within the provided chamber; and forming the aluminum oxynitride comprising passing nitrogen gas over the dispersed particles. APPLICANT HAS DISCOVERED THAT BY PROVIDING A CHAMBER HAVING A TEMPERATURE GREATER THAN OR EQUAL TO 1700 °C AND HAVING MIXTURE COMPRISING ALUMINUM OXIDE AND CARBON THE MIXTURE AGITATED IN THE CHAMBER A SINGLE HEAT TREATMENT STEP CAN PRODUCE ALON.

Claim 6 points out that the method includes introducing a mixture comprising aluminum oxide and carbon into a chamber; heating the chamber comprising ramping the temperature of the chamber to a temperature greater than or equal to 1700°C; agitating the mixture within the heated chamber to make aluminum oxynitride. Such method is not described or suggested in Maquire or Serpek taken either singly or in combination.

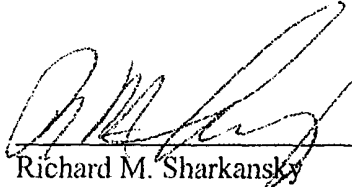
Claim 11 points out that the method includes providing a chamber having a temperature therein greater than or equal to 1700°C; introducing a first reaction mixture comprising aluminum oxide and carbon into the provided chamber; agitating the first reaction mixture within the provided chamber to form aluminum oxynitride from the first reaction mixture; removing the aluminum oxynitride while maintaining the temperature of the chamber; and introducing a second reaction mixture comprising aluminum oxide and carbon into the chamber while maintaining the temperature of the chamber.. As pointed out above, APPLICANT HAS DISCOVERED THAT BY PROVIDING A CHAMBER HAVING A TEMPERATURE GREATER THAN OR EQUAL TO 1700 °C AND HAVING MIXTURE COMPRISING ALUMINUM OXIDE AND CARBON THE MIXTURE AGITATED IN THE CHAMBER A SINGLE HEAT TREATMENT STEP CAN PRODUCE ALON. Such method is not described or suggested in Maquire or Serpek taken either singly or in combination.

In the event any additional fee is required, please charge such amount to Patent and Trademark Office Deposit Account No. 50-0845.

Respectfully submitted,

Date

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Attachment: Claim changes with markings showing changes made

VERSION OF CLAIMS WITH MARKINGS SHOWING CHANGES MADE

1. (Amended) A method of making aluminum oxynitride, the method comprising:
providing a chamber having a temperature therein equal to or greater than 1700°C;
introducing aluminum oxide particles into the provided a chamber;
dispersing the particles within the provided chamber; and
forming the aluminum oxynitride comprising passing nitrogen gas over the dispersed particles.
2. The method of claim 1, wherein forming the aluminum oxynitride comprises heating the particles.
3. (Amended) A method of making aluminum oxynitride, the method comprising:
providing a chamber having a temperature therein equal to or greater than 1700°C;
introducing a mixture comprising aluminum oxide and carbon. into the provided
chamber;
dispersing the particles within the provided chamber; and
forming the aluminum oxynitride comprising passing nitrogen gas over the dispersed
particles~~The method of claim 1, further comprising introducing carbon into the chamber to form a mixture comprising aluminum oxide and carbon.~~
4. The method of claim 1, further comprising introducing a reducing agent into the chamber to form a mixture comprising aluminum oxide and the reducing agent.
5. The method of claim 1 wherein forming the aluminum oxynitride comprises heating the mixture.
6. (Amended) A method of making aluminum oxynitride, the method comprising:
introducing a mixture comprising aluminum oxide and carbon into a chamber;

heating the chamber comprising ramping the temperature of the chamber to a temperature equal to or greater than 1700°C;

agitating the mixture within the heated chamber;~~and~~
~~heating the mixture~~ to make aluminum oxynitride.

7. The method of claim 6, further comprising:
introducing nitrogen gas into the chamber.

8. The method of claim 6, wherein agitating the mixture comprises rotating the chamber.

9. (Amended) The method of claim 1 6, further comprising:
cooling the aluminum oxynitride;
removing the aluminum oxynitride from the chamber; and
introducing a second mixture comprising aluminum oxide and carbon into ~~the~~ the
provided chamber.

10. The method of claim 6, further comprising:
forming the aluminum oxynitride into a transparent structure.

11. The method of claim 10, wherein forming the aluminum oxynitride comprises:
forming a green body comprising the aluminum oxynitride; and
sintering the green body.

12. The method of claim 11, further comprising:
isostatically pressing the sintered green body under heat.

13. The method of claim 6, wherein the aluminum oxynitride comprises $\text{Al}_{23-1/3x}\text{O}_{27+x}\text{N}_{5-x}$, where $0.429 \leq x \leq 2$.

14. (Amended) A method of making aluminum oxynitride, the method comprising:

providing a chamber having a temperature therein greater than or equal to 1700°C;
introducing a first reaction mixture comprising aluminum oxide and carbon into ~~a~~the
provided chamber;
agitating the first reaction mixture within the provided chamber;~~heating the chamber to a~~
~~temperature to~~ form aluminum oxynitride from the first reaction mixture;
removing the aluminum oxynitride while maintaining the temperature of the chamber;
and
introducing a second reaction mixture comprising aluminum oxide and carbon into the
chamber while maintaining the temperature of the chamber.

15. The method of claim 14, further comprising:

introducing nitrogen gas into the chamber.

16. The method of claim 14, wherein introducing the first reaction mixture comprises
introducing the first reaction mixture from a hopper.

17. The method of claim 14, wherein agitating the first reaction mixture comprises
rotating the chamber.

18. The method of claim 14, wherein the chamber comprises an exit opening and
removing the aluminum oxynitride comprises retracting a plunger within the chamber, thereby
allowing the aluminum oxynitride to flow through the exit opening.

19. The method of claim 14, further comprising:

forming the aluminum oxynitride into a transparent structure.

20. The method of claim 19, wherein forming the aluminum oxynitride comprises:

forming a green body comprising the aluminum oxynitride; and
sintering the green body.

21. The method of claim 20, wherein forming the aluminum oxynitride comprises:
isostatically pressing the sintered green body under heat.

22. The method of claim 14, wherein the aluminum oxynitride comprises $\text{Al}_{23-1/3x}\text{O}_{27+x}\text{N}_{5-x}$, where $0.429 \leq x \leq 2$.

23. An aluminum oxynitride made according to the method of claim 6.

24. The aluminum oxynitride of claim 23, wherein the aluminum oxynitride comprises $\text{Al}_{23-1/3x}\text{O}_{27+x}\text{N}_{5-x}$, where $0.429 \leq x \leq 2$.

25. (Amended) A method of making aluminum oxynitride, the method comprising:
providing a chamber having a temperature therein greater than or equal to 1700°C; heating
a chamber;
continuously introducing a reaction mixture comprising aluminum oxide and carbon into
the provided chamber;
agitating the reaction mixture within the provided chamber; and
continuously providing the aluminum oxynitride.

26. The method of claim 25, further comprising:
forming the aluminum oxynitride into a transparent structure.

27. The method of claim 26, wherein forming the aluminum oxynitride comprises:
forming a green body comprising the aluminum oxynitride; and
sintering the green body.

28. The method of claim 27, wherein forming the aluminum oxynitride comprises:
isostatically pressing the sintered green body under heat.

29. The method of claim 25, wherein the aluminum oxynitride comprises Al_{23} .

$\frac{1}{3}x\text{O}_{27+x}\text{N}_{5-x}$, where $0.429 \leq x \leq 2$.

30. (new) The method recited in claim 6 wherein the ramp rate is greater than 10-20 °C/min to a soak temperature of about 1700-1900 °C.

31. (NEW) The method recited in claim 30 wherein the soak time is about 10-30 minutes